

Claims

What is claimed is:

1. A cooling fluid distribution assembly for a plurality of electronic modules, said assembly comprising:

a plurality of cold plates, each of said cold plates associated with one of said plurality of electronic modules, each of said cold plates having:

a high thermal conductivity cold plate base;

a nonmetallic cold plate cover having at least one cover fluid inlet and at least one cover fluid outlet, said cover being sealably affixed to said base; and

a fluid circulation structure for directing fluid flow from said at least one cover fluid inlet to said at least one cover fluid outlet;

a plurality of flexible, nonmetallic fluid distribution conduits in fluid flow communication with said cover fluid inlets and cover fluid outlets, said conduits being bonded to said cover fluid inlets and cover fluid outlets; and

wherein said cold plates and conduits form an assembly for distributing a cooling fluid to said plurality of electronic modules, said assembly having at least one assembly fluid inlet and at least one assembly fluid outlet, said assembly having connectors only at said at least one assembly fluid inlet and said at least one assembly fluid outlet.

2. The assembly of claim 1, said assembly having one assembly fluid inlet and one assembly fluid outlet.

3. The assembly of claim 1, wherein said fluid circulation structure comprises:

a plurality of high thermal conductivity fins in thermal and mechanical contact with said base, said fins forming a plurality of fluid flow channels;

an input plenum in said cover, said input plenum in fluid flow communication with said cover inlet, said input plenum in fluid flow communication with one opening of each of said plurality of channels;

an outlet plenum in said cover, said output plenum in fluid flow communication with an opposing opening of each of said plurality of channels, said output plenum in fluid flow communication with said cover outlet; and

wherein said input plenum, said channels, and said output plenum direct fluid flow from said cover inlet, through said plurality of channels in parallel, to said cover outlet.

4. The assembly of claim 1, wherein said fluid circulation structure comprises:

a plurality of high thermal conductivity fins in thermal and mechanical contact with said base, said fins forming a plurality of fluid flow channels;

an input conduit in said cover, said input conduit in fluid flow communication with said cover inlet, said input conduit in fluid flow communication with one opening of at least one of said plurality of channels;

an output conduit in said cover, said output conduit in fluid flow communication with said cover outlet, said output conduit in fluid flow communication with an opposing end of at least one other of said plurality of channels;

a plurality of channel end connectors in said cover, each of said channel end connectors forming a fluid flow connection between one end of at least one set of channels, and one end of at least one other channel; and

wherein said input conduit, said channels, said channel end connectors, and said output conduit form a serpentine, serial fluid flow path from said cover inlet to said cover outlet.

5. The assembly of claim 1, wherein said assembly forms a series fluid flow path among said cold plates.
6. The assembly of claim 1, wherein said assembly forms a parallel fluid flow path among said cold plates.
7. The assembly of claim 1, wherein said assembly forms a combination serial and parallel fluid flow path among said cold plates.
8. The assembly of claim 1, further comprising a cooling fluid.

9. A fluid-coolable electronic module assembly comprising:

a plurality of electronic module substrate assemblies, each of said electronic module substrate assemblies having:

a substrate; and

at least one electronic device electrically connected to said substrate;

a plurality of cold plates, each of said cold plates associated with one of said plurality of electronic module substrate assemblies, each of said cold plates having:

a high thermal conductivity cold plate base, said cold plate base also providing a high thermal conductivity module cap;

a nonmetallic cold plate cover having at least one cover fluid inlet and at least one cover fluid outlet, said cover being sealably affixed to said base; and

a fluid circulation structure for directing fluid flow from said at least one cover fluid inlet to said at least one cover fluid outlet;

a plurality of flexible, nonmetallic fluid distribution conduits in fluid flow communication with said cover fluid inlets and cover fluid outlets, said conduits being bonded to said cover fluid inlets and cover fluid outlets; and

wherein said cold plates and conduits form an assembly for distributing a cooling fluid to said plurality of electronic module substrate assemblies, said fluid distribution assembly having at least one assembly fluid inlet and at least one assembly fluid outlet, said assembly having connectors only at said at least one assembly fluid inlet and said at least one assembly fluid outlet.

10. The assembly of claim 9, further comprising a cooling fluid.
11. The assembly of claim 9, said assembly having one assembly fluid inlet and one assembly fluid outlet.
12. The assembly of claim 9, wherein at least one of said plurality of modules is not coplanar with others of said plurality of modules.
13. The assembly of claim 9, wherein said fluid circulation structure comprises:

a plurality of high thermal conductivity fins in thermal and mechanical contact with said base, said fins forming a plurality of fluid flow channels;

an input plenum in said cover, said input plenum in fluid flow communication with said cover inlet, said input plenum in fluid flow communication with one opening of each of said plurality of channels;

an outlet plenum in said cover, said output plenum in fluid flow communication with an opposing opening of each of said plurality of channels, said output plenum in fluid flow communication with said cover outlet; and

wherein said input plenum, said channels, and said output plenum direct fluid flow from said cover inlet, through said plurality of channels in parallel, to said cover outlet.

14. The assembly of claim 9, wherein said fluid circulation structure comprises:

a plurality of high thermal conductivity fins in thermal and mechanical contact with said base, said fins forming a plurality of fluid flow channels;

an input conduit in said cover, said input conduit in fluid flow communication with said cover inlet, said input conduit in fluid flow communication with one opening of at least one of said plurality of channels;

an output conduit in said cover, said output conduit in fluid flow communication with said cover outlet, said output conduit in fluid flow communication with an opposing end of at least one other of said plurality of channels;

a plurality of channel end connectors in said cover, each of said channel end connectors forming a fluid flow connection between one end of at least one set of channels, and one end of at least one other channel; and

wherein said input conduit, said channels, said channel end connectors, and said output conduit form a serpentine, serial fluid flow path from said cover inlet to said cover outlet.

15. The assembly of claim 9, wherein said assembly forms a series fluid flow path among said covers.

16. The assembly of claim 9, wherein said assembly forms a parallel fluid flow path among said covers.

17. The assembly of claim 9, wherein said assembly forms a combination serial and parallel fluid flow path among said covers.